Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 120)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 + 7x^3 - 8x^2 - 4x + 2$$

$$q(x) = x^5 - 3x^4 - 9x^3 + 8x + 4$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-9)x^5 + (0)x^4 + (7)x^3 + (-8)x^2 + (-4)x^1 + (2)x^0 \\
q(x) &= (1)x^5 + (-3)x^4 + (-9)x^3 + (0)x^2 + (8)x^1 + (4)x^0 \\
p(x) - q(x) &= (-10)x^5 + (3)x^4 + (16)x^3 + (-8)x^2 + (-12)x^1 + (-2)x^0 \\
p(x) - q(x) &= -10x^5 + 3x^4 + 16x^3 - 8x^2 - 12x - 2
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 6x^2 - 4x + 8$$

$$b(x) = -4x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$-4x$	8
$-4x$	$-24x^3$	$16x^2$	$-32x$
3	$18x^2$	$-12x$	24

$$a(x) \cdot b(x) = -24x^3 + 16x^2 + 18x^2 - 32x - 12x + 24$$

Combine like terms.

$$a(x) \cdot b(x) = -24x^3 + 34x^2 - 44x + 24$$

3. Express $(x+1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 120)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -5x^3 - 26x^2 + 25x + 5 \\ g(x) &= x + 6 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+6}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-5	-26	25	5
-6		30	-24	-6
	-5	4	1	-1

So,

$$\frac{f(x)}{g(x)} = -5x^2 + 4x + 1 + \frac{-1}{x+6}$$

In other words, $h(x) = -5x^2 + 4x + 1$ and the remainder is $R = -1$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -5x^3 - 26x^2 + 25x + 5$. Evaluate $f(-6)$.

You could do this the hard way.

$$\begin{aligned} f(-6) &= (-5) \cdot (-6)^3 \ + \ (-26) \cdot (-6)^2 \ + \ (25) \cdot (-6) \ + \ (5) \\ &= (-5) \cdot (-216) \ + \ (-26) \cdot (36) \ + \ (25) \cdot (-6) \ + \ (5) \\ &= (1080) \ + \ (-936) \ + \ (-150) \ + \ (5) \\ &= \ -1 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-6)$ equals the remainder when $f(x)$ is divided by $x + 6$. Thus, $f(-6) = -1$.